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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/747,779	12/22/2000	Hong Koo Kim	000939073311	4408

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EXAMINER

PIZARRO CRESPO, MARCOS D

ART UNIT PAPER NUMBER

2814

DATE MAILED: 09/24/2002

8

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/747,779

Applicant(s)

KIM, HONG KOO

Examiner

Marcos D. Pizarro-Crespo

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) 25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-24 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Application/Control Number: 09/747,779 (Non-Final Rejection)
Art Unit: 2814

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Attorney's Docket Number: 00939-073311 US

Filing Date: 12/22/2000

Claimed Priority Dates: 3/29/2000 (Provisional 60/193,046)
12/27/1999 (Provisional 60/173,175)

Applicant(s): Kim

Examiner: Marcos D. Pizarro-Crespo

DETAILED ACTION

This Office action responds to the election (paper no. 7) filed on 7/1/2002.

Election/Restrictions

1. Claim 25 is withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in paper no. 7.

Information Disclosure Statement

2. The information disclosure statement filed 1/28/2002 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 18 and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. Line 2 of claim 18 recite the limitation "the ferroelectric film". There is insufficient antecedent basis for this limitation in the claim.

6. Line 1 of claim 19 recite the limitation "the oxide". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1, 3-10, and 13-22 are rejected under 35 U.S.C. 102(b) as being anticipated by, or in the alternative under section 35 U.S.C. 103(a) as being unpatentable over Hirai (US 5955755).

10. Hirai shows (see, e.g., fig. 1) all aspects of the instant invention including a method for fabricating a non-volatile memory device, the method comprising:

- providing a substrate **1**
- forming an oxide layer **4** overlying the substrate **1**
- forming a buffer layer **5** overlying the oxide layer **4**
- forming a ferroelectric material **6** overlying the substrate **1**
- forming a gate layer **7** overlying the ferroelectric material **6** and a channel region
- forming a first source/drain region **2** adjacent to a first side of the channel region
- forming a second source/drain region **3** adjacent to a second side of the channel region

11. Regarding claim 3, Hirai shows that the ferroelectric material may be a PZT-bearing compound (col.2/ll.40-43).

12. Regarding claim 4, Hirai shows that the buffer layer may be a magnesium-bearing compound (col.2/ll.39).

13. Regarding claim 5, Hirai shows that the buffer layer may be a magnesium-oxide layer, the magnesium-oxide layer being a barrier layer (col.2/ll.39, col.3/ll.7-10).

14. Regarding claim 6, Hirai shows that the ferroelectric material may have a thickness of less than about 1000 angstroms (col.4/ll.42).

15. Regarding claim 7, Hirai shows that the buffer layer may have a thickness of 20 nanometers (col.4/ll.13-14).

16. Regarding claim 8, Hirai shows that the ferroelectric material may have a thickness greater than 100 angstroms (col.4/ll.42).

17. Regarding claim 9, Hirai shows that the ferroelectric material may be PZT (col.4/ll.37).

18. Regarding claim 10, Hirai shows that the buffer layer is a barrier diffusion layer substantially preventing the diffusion between the ferroelectric material and the substrate (col.4/ll.62-67).

19. Regarding claim 13, Hirai shows that the buffer layer may be thermally annealed (col.7/ll.38-44).

20. Regarding claim 14, Hirai shows that the ferroelectric material is highly oriented (col.4/ll.40-41, col.5/ll.48-52).

21. Regarding claims 15 and 16, Hirai (col.10/ll.17-18) shows that the ferroelectric material is a highly oriented film (001)-thin-film.

As to the grounds of rejection under section 103(a), the polycrystallinity of Hirai's highly-oriented ferroelectric material is an inherent property. Hirai shows that the ferroelectric material is a highly-oriented thin-film showing a (001)-face (col.4/ll.50-52), but fails to specify that it is also polycrystalline or not amorphous. Nonetheless, (001)-PZT planes are polycrystalline (see remarks section below).

See MPEP § 2112, which discusses the requirements of rejections based on an inherent claimed characteristic and recommends the alternative (§102/ §103) grounds of rejection.

22. Regarding claim 17, Hirai shows that the polycrystalline film is greater than 100 angstroms (col.4/ll.42).

23. Regarding claim 18, Hirai shows that the buffer layer is a template to provide an oriented growth of the ferroelectric film (col.4/ll.31-35)

24. Regarding claim 19, Hirai shows that a dry-oxidation process comprising an oxygen-bearing compound may form the oxide layer (col.9/ll.58-61).

25. Regarding claim 20, Hirai shows that the oxide layer is silicon dioxide (col.9/ll.58).

As to the grounds of rejection under section 103(a), the substrate-surface passivation-property is an inherent property to Hirai's oxide layer. Hirai's oxide layer is made of silicon dioxide. However, Hirai fails to explicitly describe that the oxide layer passivates the surface of the substrate. Nonetheless, Hirai's oxide layer is characterized by its passivation effect on the surface of the substrate (see remarks section below).

See MPEP § 2112, which discusses the requirements of rejections based on an inherent claimed characteristic and recommends the alternative (§102/ §103) grounds of rejection.

26. Regarding claim 21, Hirai shows (see, e.g., fig. 1) most aspects of the instant invention including a method for fabricating a non-volatile memory device, the method comprising:

- providing a substrate **1**
- forming a first buffer layer **4** overlying the substrate **1**
- forming a second buffer layer **5** overlying the first buffer layer **4**
- forming a ferroelectric material **6** overlying the substrate **1**

- forming a gate layer **7** overlying the ferroelectric material **6** and a channel region
- forming first and second doped regions **2, 3** adjacent to first and second ends of the channel region

27. Regarding claim 22, Hirai shows that the first buffer layer is a gate oxide layer (col.7/ll.38) and that the second buffer layer may be a MgO layer (col.2/ll.39).

28. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai in view of Yamazaki (US 6072724).

29. Regarding claim 2, Hirai shows most aspects of the instant invention (see paragraphs 10-27 above). Hirai, however, fails to specify that the channel region be about 1 micron or less.

Yamazaki (col.2/ll.45-46), on the other hand, teaches that it is known that the channel length is an important design parameter that will determine the channel current of the transistor.

Consequently, it would be an obvious matter of design choice to select a suitable channel length for the transistor of Hirai, as suggested by Yamazaki, since the channel length is a variable of importance subject to routine experimentation and optimization and it is not inventive to discover the optimum or workable ranges by routine experimentation.

30. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai, as applied to claim 1 above, further in view of Van Zant and Evetts (US 5361720).

31. Regarding claim 11, Hirai shows most aspects of the instant invention (see paragraphs 10-27 above), except for sputtering the buffer material from a substantially pure magnesium target to form a magnesium oxide layer. Hirai differently deposits the magnesium layer using vacuum evaporation (col.4/ll.10-12).

Van Zant (pp.412), however, teaches that there are several advantages to the use of sputtering over vacuum evaporation. One is the improvement in step coverage. Evetts (col.2/ll.15-20), on the other hand, teaches that the sputter deposition from a magnesium metal target in a sputtering gas comprising oxygen is a preferred method of forming a high-quality MgO layer.

Consequently, it would have been obvious at the time of the invention to one of ordinary skill in the art to sputter Hirai's buffer layer from a magnesium target to form the MgO layer, as suggested by Van Zant and Evetts, in order to improve the step coverage while forming a high-quality MgO layer.

32. Regarding claim 12, Hirai shows most aspects of the instant invention (see paragraph 10-27 above). In addition, Evetts (col.2/ll.2) shows that the deposition temperature may be as low as 540°C. Hirai/Van Zant/Evetts, however, fails to teach a sputtering temperature between 400-500°C.

In spite of the above, generally, differences in temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the workable

ranges by routine experimentation". *In re Aller*, 220 F.2d 454,456,105 USPQ 233, 235 (CCPA 1955).

There is no evidence supporting the claimed temperature range, *i.e.*, 400-500°C, as critical to the invention, and therefore it would have been obvious.

33. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai in view of Iyer (US 5629246).

34. Regarding claim 23, Hirai shows most aspects of the instant invention (see paragraphs 10-27 above). Hirai (col.4/ll.49) also shows that the second buffer layer is a highly-oriented layer. Hirai, however, fails to show that the first buffer layer is an amorphous layer.

Nonetheless, Hirai shows that the first buffer layer is a silicon-dioxide layer, which is used as a dielectric. As taught by Iyer (col.1/ll.16-20), silicon dioxides used as dielectrics in integrated circuits are typically amorphous materials.

Consequently, it would have been obvious at the time of the invention to one of ordinary skill in the art at the time of the invention that Hirai's first buffer layer is amorphous, as taught by Iyer, since the first buffer layer is a silicon dioxide layer used as a dielectric and silicon dioxides used as dielectrics in integrated circuits are typically amorphous.

35. Regarding claim 24, although Hirai does not show the second buffer layer having a thickness not greater than 10 nm, he shows that the first buffer layer may be approximately 14 nm (col.12/ll.3). Hirai's thickness appears to be closed enough to the claimed thickness range that one of ordinary skill in the art would have expected Hirai's

layer to have the same properties as those of the claimed layer; consequently, it would have been obvious. *Titanium Metal Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985).

Moreover, it would be an obvious matter of design choice to have the second buffer layer having a thickness not greater than 10 nm, instead of 14 nm, since such a modification would have involved a mere change in the size of the second buffer layer. A change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 USPQ 237 (CCPA 1955).

Remarks

36. As taught by Auciello (US 5453661/col.5/ll.7-25), the highly-oriented ferroelectric film of Hirai that mainly shows the X-ray (001)-diffraction peak is polycrystalline.

37. As taught by Van Zant (pp.154-155), silicon dioxide layers are characterized by its passivating effect over the surface of a substrate.

Conclusion

38. Papers related to this application may be submitted directly to Art Unit 2814 by facsimile transmission. Papers should be faxed to Art Unit 2814 via the Art Unit 2814 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2814 Fax Center number is **(703) 308-7722** or **-7724**. The Art Unit 2814 Fax Center is to be used only for papers related to Art Unit 2814 applications.

39. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Marcos D. Pizarro-Crespo** at **(703) 308-6558** and

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between the hours of 9:00 AM to 7:30 PM (Eastern Standard Time) Monday through Thursday or by e-mail via Marcos.Pizarro@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

40. Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

41. The following list is the Examiner's field of search for the present Office Action:

Field of Search	Date
U.S. Class / Subclass(es): 257/295, 438/3, 365/145	9/11/2002
Other Documentation: PLUS Analysis	9/11/2002
Electronic Database(s): EAST (USPAT, EPO, JPO)	9/11/2002

Marcos D. Pizarro-Crespo


Patent Examiner

Art Unit 2814

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MDP/mdp
September 12, 2002


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